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Funding Science with Science: Cryptocurrency and Independent Academic Research Funding

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RESEARCH ARTICLE

Funding Science with Science: Cryptocurrency and Independent Scientific Funding

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Abstract. Scientific funding within the academy is an often complicated affair involving disparate and competing interests. Private universities, for instance, are vastly outpacing public institutions in garnering large, prestigious grants. Inequities also extend to the kinds of research funded, with government, corporate, and even military interests privileging certain types of inquiry. This work proposes an innovative type of research fund using cryptocurrencies, a fast-growing asset class. Although not a total funding solution, staking coins, specifically, can be strategically invested in to yield compound interest. These coins use masternode technologies to collateralize the network and speed transaction pace. Additionally, these staking coins pay dividends to masternode holders, so an institution that purchases these types of central hubs could potentially engage in a lucrative form of dividend reinvestment. Using cryptocurrencies as a new funding stream, it is possible that simply garnering large amounts of capital and creating a nonprofit institute could also be the future of funding scientific research.

KEY WORDS

1. Funding basic science. 2. Masternodes. 3. Scientific funding.
4. Staking coins.

1. Introduction

The funding of scientific research in the United States currently operates as an intergovernmental and private equity exercise in which monies from federal organizations, private institutions, businesses, and high-net-worth individuals provide the financial capital for the production of scientific knowledge. This system functions not straightforwardly but as an often complicated affair, involving disparate stakeholders competing for the intellectual property that research produces and researchers vying to extend their respective funding streams. It also determines the kinds of research that receive funding in the first place, with corporate and even military interests, for instance, privileging certain types of inquiry. This intersection of private, governmental, and university interests erects obstacles to the sustained production of scientific knowledge. However, at least some of these impediments can be removed by using proprietary technology to create an index fund of cryptocurrency in order to generate capital for research wholly independent of the existing funding system, especially the

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grant system. This cryptocurrency portfolio would increase funding and endowment opportunities, open avenues of research not typically favored by governmental and commercial backers, and render feasible more progressive and arguably more effective models of cooperative research.

Scientific funding for research can, paradoxically, hinder and even preclude novel inquiry.[2,13] Further, the way in which resources dedicated to scientific inquiry are garnered and spent spotlights a series of complicated problems that extend beyond funding mechanisms. Ioannidis[9] noted the dangers of a triumphalist narrative about scientific advancement in an atmosphere of already limited resources and pressure for further budget cuts, in which “vocal and aggressive competitors” receive funding over “appropriately cautious and self-critical” researchers and high-risk “innovative ideas already struggle to find support” (p. 2483). To Ioannidis’s point, competition for scientific resources and knowledge is fierce, and, troublingly, scientific inquiry and funding policies are greatly influenced by policy-makers who often lack the experience or knowledge to properly make critical decisions.[8] Haller and Gerrie[8] noted that governmental and business interests frequently commission supposed scientific experts to support proposals and funding initiatives that are, incongruously, not vetted scientifically. This occurs frequently, for example, as an effect of the lobbying industry. Similarly, Greenwood and Levin[7] discussed the increasing separation of the academic world from the governmental procedures that dictate the very policies to which academic researchers must adhere. As a counter-narrative to these processes, McKinley *et al.*[17] proposed “citizen science,” engaging the public in scientific projects, as a way to more fully examine scientific spending and policies. In proposals that are more theoretical than policy driven, McKinley *et al.* presented citizen science as mitigating the dominance of scientific inquiry by industrial and other powerful external stakeholders.[17] McKinley *et al.*’s conception of citizen science is a twofold process that includes collective domain knowledge building and political action. This distributed model of scientific labor and decision-making provides a useful way to think about disrupting the current concentration in relatively few hands of funding and resources. One way to enact such disruption is to develop financial tools with which to reduce researchers’ reliance on governmental and commercial interests.

McKinley *et al.*’s model, as democratic and distributive as it is, overlooked that funding for basic research is at the center of most scientific developments.[17] Moro and Chomsky[20] illustrated, albeit ambivalently, how governmental support for basic research has catalyzed American technological advances, new industries, and wealth-generating opportunities. Reif[23] underscored that funding for basic research furnishes the anchor point for most innovations. Although Reif’s contentions also focus on American outcomes, his point is nonetheless salient for scientific improvements worldwide.

2. Re-Envisioning the Funding of Science

The established process for funding scientific inquiry and its later deployment into enterprise has been remained relatively unchallenged. Ioannidis,[9] Reif,[23] and Moro and Chomsky[20] made recommendations within the confines of existing policy rather than proposing alternatives to this process. A body of literature exists, including McKinley *et al.*[17] and, to a lesser degree, the work of science educators Roth and Barton,[24] that does propose an alternative. However, such work may underestimate the political power of higher education institutions, government, and commercial forces to continue to appropriate the power of science. Shore[25] described such appropriation as “neo-liberal,” in that it attempts to privatize public goods—in

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this instance, scientific research. With neoliberal ideology and practices firmly entrenched, there often appears to be little incentive, particularly for the well-funded scientific researcher, to challenge the current system. Lehner and Finley[14] contended that university researchers could easily follow a careerist path, predicated on publishing in high-ranking academic journals and collecting funding from traditional sources, yet void of more substantial contributions to science. The result is often that the current funding system goes under-examined or that critics such as Shore[25] and Strathern[26] offer few practical ways to redress fundamental, systemic problems.

In contrast, the approach outlined in this paper repositions the funding of scientific inquiry by proposing concrete steps to create one alternative path. Currently, governmental authorities, private grant officers, and other donors act as *de facto* trustees in the funding of science. Moving away from merely theorizing the dynamics of power within scientific funding, this work proposes a set of financial tools to fund science without any intermediaries—in other words, without the obligations entailed by accepting National Institutes of Health (NIH), National Science Foundation (NFS), or other types of external funding. The model for this financial tool was informed by Lincoln and Guba's[16] and Tobin's[27,28] notion of catalytic authenticity, as well as by Christensen's[3] conception of technological disruption. In addition, it refines Levi-Strauss's[15] understanding of bricolage, employed in recent years as a methodology by social scientists such as Denzin and Lincoln[5] and Kincheloe, McLaren, Steinberg, and Monzó,[12] from a method of inquiry into a force for scientific funding. Fundamentally, bricolage is about reassembling what is at hand into new configurations. In this paper's approach, that new configuration involves creating a technological disruption by combining existing cryptocurrencies and investment strategies to generate a new, alternative path to fund scientific research.

3. Underfunded Universities and New Investment Models: A Case Study

As hubs of scientific research in competition for increasingly scarce funds, universities provide an illustrative example both of the challenges facing researchers and the solution offered by a cryptocurrency index fund. One such challenge lies in how the funding system is skewed in favor of certain institutions, which can stifle innovation. For instance, Ali, Bhattacharyya, and Olejniczak[1] noted a pattern of social reproduction—a mechanism by which existing hierarchical social structures reproduce themselves, thereby maintaining the status quo—and contended that institutional resources profoundly influence the degree to which private universities are vastly outpacing public institutions in garnering NIH and NFS grants, along with other prestigious and often generous research funding. While one may argue that the distribution of such grants merely reflects the merit of these private institutions, measured in their ability to attract distinguished faculty and, via institutional endowments, to support extensive research and pass down intellectual capital, there is little doubt that a more egalitarian playing field in scientific research would yield at least a more diverse range of studies and interpretations. Further, since wealthier private institutions already possess an advantage when it comes to funding, their dominance in scientific research and its lines of inquiry becomes self-sustaining, which itself is potentially problematic.

Despite governmental efforts, funding directed toward public institutions continues to decline across all areas, but also specifically for science research—remaining substantively lower than pre-2007 levels.[21] Mortenson, a senior scholar at the Pell Institute, has extensively examined declines in state funding, detailing yearly reductions in nearly every state since

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1976, which have consequently increased the importance of competitive grant funding and existing endowments.[21] Goetzmann, Griswold, and Tseng[6] underscored how poorly traditional educational endowments performed during and directly after the 2008 financial crisis. According to the Educational Endowment Report (2009), the average university endowment lost nearly a quarter of its market value between early July and December 2008.[6] Commenting on this trend, Goetzmann *et al.* noted that "liquidity problems were a reason for basic changes in strategy and services" (p. 112).[6] Goetzmann *et al.* further underscored that "endowment managers today, as in the 1930s, must not only calibrate their risk tolerance, but they must also calibrate their uncertainty tolerance, that is, the extent to which they can commit to an investment strategy with only slim statistical evidence to rely on" (p. 113).[6] This approach to endowment management and, more broadly, to the funding of science may provide a propitious opportunity, in light of shrinking funding, to augment and, to a degree, restructure current financial models to include more experimental investments that broaden the horizons of potential margins. As an alternative funding model, cryptocurrencies can be foundational to this shift.

Underfunding with grants and endowments is not simply a fiscal issue but also an issue of how money is distributed. While some scholars posit that endowment spending dollars are used to fund financial aid, the reality is that "spending from endowment funds is at an all-time low"[19] (p. 11), which affects areas like research quite heavily. Further, reported payout "includes management and custody fees and actually gives an inflated impression of how much schools are spending" on research.[19] Miller and Munson cited a 3.9% endowment payout to "activities related to their mission," a .3% drop from pre-2007 levels.[19] This means that "colleges and universities are spending less now than they have in decades and are hoarding more" (p. 11),[19] forcing researchers in science to rely more extensively on limited, competitive external funding. Decentralized investment technology offers one path to using more endowment funding for research purposes and to using it more equitably.

Meyer and Zhou[18] provided a model to which institutions may aspire. Current financial products exist that synthesize Meyer and Zhou's appraisal of elite private endowment performance with Christensen's[3] and Christensen and Overdorf's[4] notion of technology distribution. In particular, cryptocurrencies have been arguably the fastest growing asset class of 2017, producing significant new wealth. At the time of writing, United States Treasuries are yielding nearly record lows, casting alternative asset classes as a potential portfolio diversifier for many endowments. As a diversifier, the new cryptocurrency asset class has enormous growth potential, and, although cryptocurrencies should not be understood as a total solution for scientific funding, in universities or elsewhere, they do provide a greater level of diversification and adhere to Modern Portfolio Management Theory. Further, they are highly uncorrelated to traditional asset classes, thus hedging against a more universal risk, as outlined by Goetzmann *et al.*[6]

4. Staking Coins as a Funding Source for Scientific Research

As explained above, one way to circumvent the underfunding of science is to utilize cryptocurrencies as a new growth model. Kimball and Johnson[11] noted that, historically, much of the success of early university endowments stemmed from publishing detailed treasurer's statements to entice donors. Open publishing of endowments is no longer practiced, as most universities operate as nonprofits and are not compelled to disclose such information. However, as underscored by Kimball and Johnson,[11] and again by Kimball,[10] the open policy

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of endowment funding more effectively encouraged contributions, substantially increasing funding. Placing endowments on the blockchain may have a similar effect, ushering in a new influx of funding. Open, decentralized ledgers, contrary to current practices, may inaugurate such growth by creating transparency regarding how funds are garnered and spent. Indeed, current, real-time crowdfunding models arguably work most effectively when they display the accumulation of funding.

However, universities are far from the only sites of scientific research that could benefit from a crypto index fund. It is possible, even desirable, that simply garnering large amounts of capital to create nonprofits or institutes could comprise the future of funding scientific research. This approach may be best exemplified by the $250 million donation by Sean Parker, first President of Facebook, Inc., for the creation of the Parker Institute for Cancer Immunotherapy (PICI). There is little doubt that consortia akin to PICI represent a forward-facing vision of science, a future that cryptocurrencies may help to bring about. PICI does not necessarily need specific goals for continual funding (contrary to most government grants, which are entirely dependent on hundreds of predetermined criteria); the overarching ethos of the institute is that the best scientific work occurs during exploratory phases that traditional research grants simply are not engineered to support. In some cases, rigorous spending regulations even result in funds being wasted in order to remain in compliance. Additionally, Parker's initiative is unique in that rival universities' researchers collaborate and can access other researchers' aggregated data through a PICI portal.[22] If this approach became more standard, scientific research might progress much more quickly and perhaps with more accuracy. The undergirding principles informing PICI, increased flexibility in spending and discretion over funds, may be replicable via cryptocurrency investment.

The hundreds of successful initial coin offerings (ICOs) on the Ethereum network serve as a case in point for alternative funding. Ethereum, in addition to other new fundraising platforms (NEO, EOS, LISK, etc.), provides a view into new forms of fundraising. In particular, at the time of writing, NEO has surged into the fifth spot for all cryptocurrencies. NEO's recent dramatic increase in value is somewhat paradoxical, in that NEO is not fully a cryptocurrency as such. NEO, like the other coins mentioned, functions almost exclusively as a fundraising platform for other crypto projects.

Admittedly, science funders must consider a variety of sometimes obscure and heterodox factors when selecting an altcoin that may yield sufficient gains. For example, NEO's ties to China could affect changes in its value. Indeed, the cryptocurrency market has seen a sharp increase in Chinese versions of existing open-source coin projects. The launch of Genaro, the Chinese version of Filecoin, is but one example, and many see NEO as the Chinese version of Ethereum. Another factor to consider is how outside actions have affected coin value growth. For example, Poloniex, one exchange where altcoins are traded, delisted 17 coins in May 2017. This action may have led to a sharp increase in a large percentage of altcoins' valuations. Such considerations present complications, however, rather than insurmountable obstacles.

5. How It Works: Investment Model Methodology

Predicated on a working prototype funded with staking coins, this project positions the current working model for use by science-focused institutions, including research-intensive universities. The prototype could potentially diversify funding for science by purchasing staking coins and subsequently engaging in a lucrative form of dividend reinvestment. The

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innovative deployment of staking coins can become a way to fund scientific research that operates not only outside the traditional banking and investment space but also beyond the parameters of National Science Foundation and NIH funding. Staking cryptocurrencies, such as PIVX, Dash, and a number of others, are fully backed by the complexity of cryptography while simultaneously earning dividends. Even though staking coins are prone to volatile price extremes, a staking coin's dividend features tend to offset price fluctuations. The dividend features of staking coins may position them as a prudent and potentially lucrative choice for science funding diversification.

Fig. 1 details one particular strategy that deploys staking coins to fund science. As demonstrated in the working prototype, the model fully transitions from a theoretical discussion of funding to both an axiological and ontological investment construct. Specifically, the model envisions how Dash and PIVX, requiring 1,000 coins and 10,000 coins respectively, could function as a way to fund research. The example below notes how central hubs, often called masternodes, could generate capital. The model underscores how central hubs generate dividends, as seen in the shared pool. Once these dividends reach the threshold

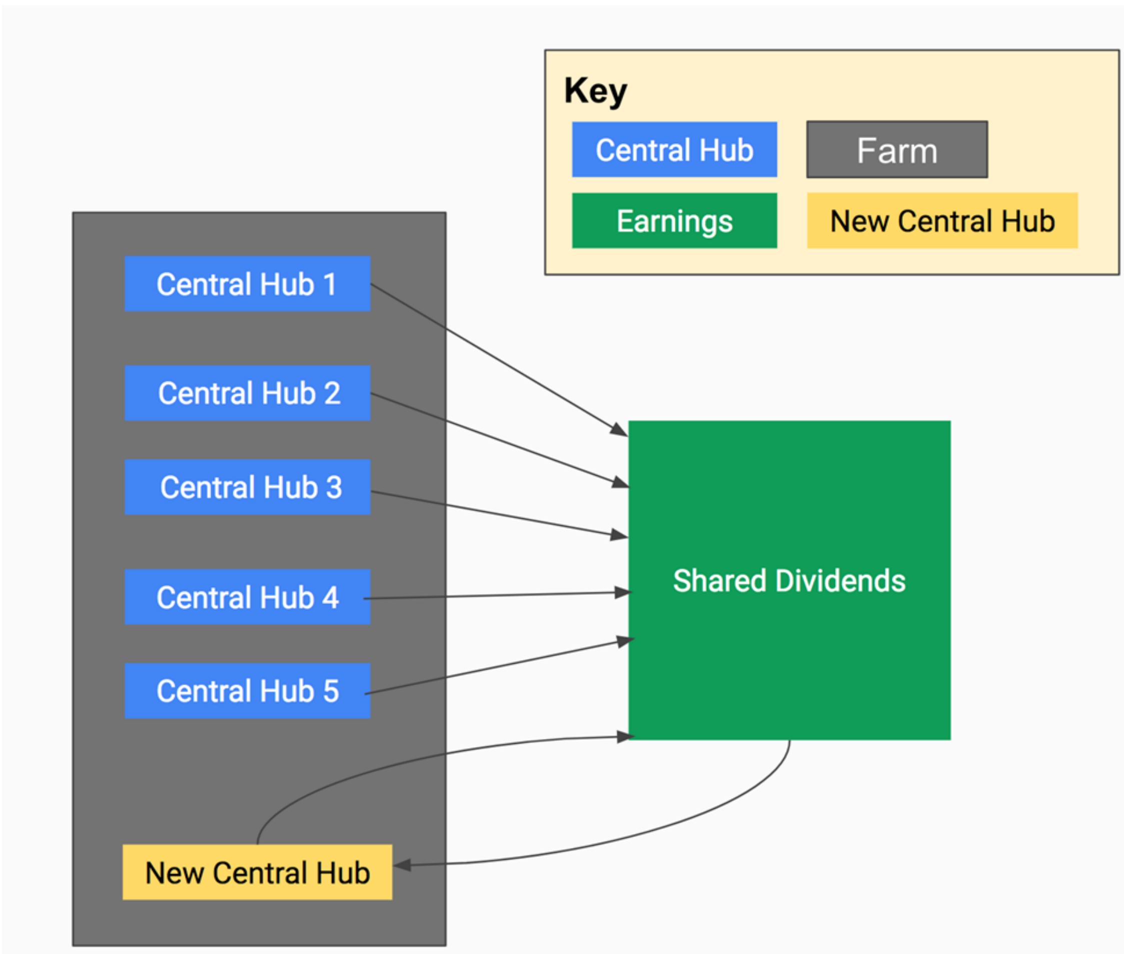

Fig. 1. Model for staking coins for scientific funding.

to acquire an additional central hub, a new central hub can be created, earning even more dividends.

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The model in Fig. 1 depicts one deployment of staking coins for the purposes for scientific funding. It provides a nonstatic, compound interest vehicle that leverages the complexities of software engineering for the purposes of science. This is not a conceptual model: over the past ten months, this group of researchers, in conjunction with software engineers, has built and used this model, seeing substantial monetary gain. This model holds great promise to augment funding for science, though the prototype needs to be more fully tested and should serve primarily as a portfolio diversifier rather than a total funding solution.

Fig. 2. Year-to-date increases for Dash and PIVX, retrieved from coinmarketcap.com.

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Above, Fig. 2 highlights the growth of both Dash (from February 2014 to August 2017) and PIVX (from February 2016 to August 2017).

6. Limitations and Development Hurdles

Although staking coins are potentially lucrative, further research is required to more fully explore their viability as a long-term strategy. The current work is based on a model deployed by the researchers in tandem with private investors. Indeed, the authors are keenly aware of the paradox in calling for independent scientific funding via staking coins based on a prototype developed jointly with bankers. Nonetheless, the purpose of this proposal is more important than the allies who have helped to create the prototype. Further, the strategy of staking coins, moving away from the relatively static proof of work concept, has potential for scientists and has generated substantial new capital. That said, proof of stake coins, specifically, can be seen as unfair to newcomers because they have the propensity to favor those with preexisting market advantages and are based on a network effect. However, the utilization of this network effect for the public good counterbalances any concerns about proof of stake coins within the fund, as the social intelligence and reputation often required to participate are already achieved within the prototype itself; surely, leveraging a coin's potentially exclusionary characteristic for the greater good cannot be construed as harmful. As for raising capital via an ICO, the authors acknowledge the risk of an under-valuation without sufficient publicity but are confident that the product speaks for itself and will allow for the fund eventually to be valued by its worth alone (notwithstanding that the fund generates capital wholly independently of its coin value).

In addition to more research and prototyping, new development tools such as better coin control tools and monitoring mechanisms are required and/or need to be made publicly available on Github or another developer forum. The authors are aware of the potential for fraud but are optimistic that the type of research and reconnaissance done by the team in developing the prototype can guard against it. There are, of course, those who wonder about incoming regulations from the Securities and Exchange Commission and international governance bodies with regard to the efficacy of ICOs. The authors have consulted with and had the prototype approved by a battery of lawyers, regulators, and licensers.

7. Conclusion

Many intricacies encumber the process of funding scientific research within the United States. Federal organizations, private institutions, businesses, and individual donors each contribute monies in a variety of ways, making for a confusing system at best and a purposefully shrouded one at worst. Multiple interests are at play when it comes to backing scientific research of all kinds. Historically, there has not been an institutionalized opportunity to bypass this system, but cryptocurrencies can now challenge its supremacy. Cryptocurrencies and blockchain technologies offer a reprieve from the staunchly traditional endowment and grant models that depend on structures (often as limiting methodologically as they are insufficient financially) that have plagued scientific funding since the late nineteenth century and continue to do so well into the twenty-first. This paper argues that using open-source staking algorithms may be one alternative to the relatively static streams of governmental and private funding. In particular, this work underscores how cryptocurrencies may generate capital for scientific funding via dividend reinvestment. This dividend reinvestment approach not only may be both

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more egalitarian and accessible, but also may drive innovation by granting researchers an independence and ability to collaborate rather than compete that will benefit them, their colleagues, and the public good.

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Author Contributions

This work was jointly written by Edward Lehner, Dylan Hunzeker, and John R. Ziegler, all contributing equally.

Conflict of Interest

EL, DH, and JZ have no affiliation with the Dash or PIVX communities.

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